This listing of claims will replace all prior versions and listing of claims in the application:

Listing of the Claims

Claims 1-34 (canceled).

Claim 35 (original): A method for detecting faults in a control loop for a pneumatically operated control valve, the control loop including an actuator, second stage pneumatics having a control fluid valve assembly responsive to a pressure signal for controlling flow of control fluid to the actuator, an I/P converter adapted to receive an I/P drive signal and generating the pressure signal, and a processor for delivering the I/P drive signal to the I/P converter, the method comprising:

defining a normal range for a control parameter of the control loop;

triggering a fault signal for operation of the control parameter outside the normal range;

characterizing operating parameters of the control loop during the fault signal to derive a fault template;

comparing the fault template to sets of stored operating parameters associated with specific component failures; and

identifying at least one specific component failure having a set of stored operating parameters that matches the fault template.

Claim 36 (original): The method of claim 35, in which the second stage pneumatics comprises a spool valve, and in which the control parameter comprises a spool valve position signal.

Claim 37 (original): The method of claim 35, in which the second stage pneumatics comprises a pneumatic relay having a beam, and in which the control parameter comprises a beam position signal.

Claim 38 (original): The method of claim 35, in which the control parameter comprises an I/P drive signal.

Claim 39 (original): The method of claim 35, in which characterization of the operating parameters includes:

characterizing an I/P drive signal deviation as high or low;

characterizing an error signal as largely positive, null, or largely negative, wherein the error signal is equal to a reference signal minus an actuator travel signal;

characterizing an outlet port differential pressure as negative, nominal, or positive, wherein the outlet port differential pressure is equal to a first outlet port pressure minus a second outlet port pressure; and

characterizing a control fluid valve assembly position as largely positive, null, or largely negative.

Claim 40 (currently amended): The method of claim 39, in which characterization of the operating parameters further includes characterizing the reference signal after the I/P drive signal deviation has been characterized but before the error signal, outlet port differential pressure, and ~~spool~~ control fluid valve assembly position have been characterized.

Claim 41 (original): The method of claim 39, in which a fault template comprising a high I/P drive signal deviation, largely positive error signal, negative outlet port differential pressure, and largely negative control fluid valve assembly position is attributable to one of a group of component faults consisting of a jammed spool valve, an inlet O-ring failure, a diaphragm failure, and a blocked primary orifice.

Claim 42 (original): The method of claim 39, in which a fault template comprising a high I/P drive signal deviation, largely positive error signal, nominal outlet port differential pressure, and largely positive control fluid valve assembly position is attributable to one of a group of component faults consisting of an external leak, a worn spool valve, and a low supply pressure.

Claim 43 (original): The method of claim 39, in which a fault template comprising a high I/P drive signal deviation, largely positive error signal, nominal outlet port differential pressure, and largely negative control fluid valve assembly position is attributable to a low supply pressure.

Claim 44 (original): The method of claim 39, in which a fault template comprising a high I/P drive signal deviation, largely positive error signal, positive outlet port differential pressure, and largely positive control fluid valve assembly position is attributable to one of a group of component faults consisting of a throttling element stuck at low travel, a blocked air line, and an active interlock.

Claim 45 (original): The method of claim 39, in which a fault template comprising a high I/P drive signal deviation, null error signal, nominal outlet port differential pressure, and null control fluid valve assembly position is attributable to one of a group of component faults consisting of a partially plugged primary orifice, grit in the armature, and a shift in I/P calibration.

Claim 46 (original): The method of claim 39, in which a fault template comprising a low I/P drive signal deviation, largely negative error signal, positive outlet port differential pressure, and largely positive control fluid valve assembly position is attributable to one of a group of component faults consisting of a blocked I/P nozzle, a pressed I/P armature, a latched I/P, and a jammed spool valve.

Claim 47 (original): The method of claim 39, in which a fault template comprising a low I/P drive signal deviation, largely negative error signal, negative outlet port differential pressure, and largely negative control fluid valve assembly position is attributable to one of a group of component faults consisting of a valve stuck in a high position and a blocked air line.

Claim 48 (original): The method of claim 39, in which a fault template comprising a low I/P drive signal deviation, null error signal, nominal outlet port differential pressure, and null control fluid valve assembly position is attributable to one of a group of component faults consisting of a shift in I/P calibration and a partially plugged I/P nozzle.

Claim 49 (original): A control loop for positioning a throttling element of a pneumatically operated control valve, the control loop comprising:

an actuator for driving the throttling element, the actuator defining first and second control chambers;

second stage pneumatics having an inlet port in fluid communication with a control fluid supply, first and second outlet ports in fluid communication with the first and second actuator control chambers, respectively, and a control fluid valve assembly for controlling flow of control fluid from the inlet port to the first and second outlet ports;

an I/P converter having a pressure-responsive diaphragm engaging the control fluid valve assembly, the I/P converter further including an inlet in fluid communication with the control fluid supply and an outlet for directing control fluid to the diaphragm;

at least one sensor for detecting an operating parameter;

a processor communicatively coupled to the at least one sensor for providing a drive signal to the I/P converter; and

a diagnostics unit communicatively coupled to the processor, the diagnostics unit including a memory programmed to:

define a normal range for the operating parameter;

trigger a fault signal for operation of the control parameter outside of the normal range;

characterize operating parameters of the control loop during the fault signal to derive a fault template;

compare the fault template to sets of stored operating parameters associated with specific component failures; and

identify at least one specific potential component failure having a set of stored operating parameters corresponding to the fault template.

Claim 50 (original): The control loop of claim 49, in which the control fluid valve assembly comprises a spool valve, and in which the control parameter comprises a spool valve position signal.

Claim 51 (original): The control loop of claim 49, in which the control fluid valve assembly comprises a pneumatic relay having a beam, and in which the control parameter comprises a beam position signal.

Claim 52 (original): The control loop of claim 49, in which the control parameter comprises an I/P drive signal.

Claim 53 (original): The control loop of claim 49, in which the at least one sensor comprises an inlet port sensor in fluid communication with the second stage pneumatics inlet port, a first outlet port sensor in fluid communication with the second stage pneumatics first outlet port, a second outlet port sensor in fluid communication with the second stage pneumatics second outlet port, and a displacement sensor for determining a control fluid valve assembly position, and in which the memory is programmed to:

characterize an I/P drive signal deviation as high or low;

characterize an error signal as largely positive, null, or largely negative, wherein the error signal is equal to a reference signal minus an actuator travel signal;

characterize an outlet port differential pressure as negative, nominal, or positive, wherein the outlet port differential pressure is equal to a first outlet port pressure minus a second outlet port pressure; and

characterize the control fluid valve assembly position as largely positive, null, or largely negative.

Claim 54 (currently amended): The control loop of claim 53, in which the memory is further programmed to characterize the reference signal after the I/P drive signal deviation has been characterized but before the error signal, outlet port differential pressure, and ~~spool~~ control fluid valve assembly position have been characterized.

Claim 55 (original): A method for detecting faults in a control loop for a pneumatically operated control valve, the control loop including an actuator, a control fluid valve assembly adapted to receive a pressure signal and control flow of control fluid to the actuator, an I/P converter coupled to the control fluid valve assembly, and a processor for delivering an I/P drive signal to the I/P converter, the method comprising:

monitoring the I/P drive signal and at least one operating parameter of the control loop;

generating a fault signal based on the I/P drive signal and the at least one operating parameter in accordance with a logic sub-routine.

Claim 56 (original): The method of claim 55, in which the at least one operating parameter comprises a control fluid valve assembly position.

Claim 57 (original): The method of claim 56, in which the fault signal is generated when the I/P drive signal exhibits a sustained increase and the control fluid valve assembly position is at null.

Claim 58 (original): The method of claim 57, in which the fault signal indicates a plugged primary orifice in the I/P converter.

Claim 59 (original): The method of claim 57, in which the fault signal indicates a failure of an outlet O-ring in the I/P converter.

Claim 60 (original): The method of claim 56, in which the fault signal is generated when the I/P drive signal exhibits a sustained decrease and the control fluid valve assembly position is positive.

Claim 61 (original): The method of claim 60, in which the fault signal indicates a plugged nozzle in the I/P converter.

Claim 62 (original): The method of claim 60, in which the control fluid valve assembly comprises a spool valve and the control fluid valve assembly position comprises a spool valve position.

Claim 63 (original): The method of claim 60, in which the control fluid valve assembly comprises a pneumatic relay having a beam, and the control fluid valve assembly position comprises a beam position.

Claims 64-70 (canceled).